General

Guideline Title

Initial closed reduction of cervical spinal fracture-dislocation injuries. In: Guidelines for the management of acute cervical spine and spinal cord injuries.

Bibliographic Source(s)

Gelb DE, Hadley MN, Aarabi B, Dhall SS, Hurlbert RJ, Rozzelle CJ, Ryken TC, Theodore N, Walters BC. Initial closed reduction of cervical spinal fracture-dislocation injuries. In: Guidelines for the management of acute cervical spine and spinal cord injuries. Neurosurgery. 2013 Mar;72(Suppl 2):73-83. [48 references] PubMed

Guideline Status

This is the current release of the guideline.

Recommendations

Major Recommendations

The rating schemes used for the strength of the evidence (Class I-III) and the levels of recommendations (Level I-III) are defined at the end of the "Major Recommendations" field.

Recommendations

Level III

- Early closed reduction of cervical spinal fracture/dislocation injuries with craniocervical traction for the restoration of anatomic alignment of the cervical spine in awake patients is recommended.
- Closed reduction in patients with an additional rostral injury is not recommended.
- Magnetic resonance imaging (MRI) is recommended for patients with cervical spinal fracture dislocation injuries if they cannot be examined during closed reduction because of altered mental status or before either anterior or posterior surgical procedures when closed reduction has failed. Prereduction MRI performed in patients with cervical fracture dislocation injuries will demonstrate disrupted or herniated intervertebral disks in one-third to one-half of patients with facet subluxation injuries. These findings do not appear to influence outcome following closed reduction in awake patients, and therefore, the utility of prereduction MRI in this circumstance is uncertain.

Summary

In the data derived from the literature published to date, closed reduction of fracture/dislocation injuries of the cervical spine by traction-reduction appears to be safe and effective for the reduction of acute traumatic spinal deformity in awake patients. Approximately 80% of patients will have their cervical fracture dislocation injuries reduced with this technique. The overall permanent neurological complication rate of closed reduction is

approximately 1%. The associated risk of a transient injury with closed reduction appears to be 2% to 4%. Closed traction-reduction appears to be safer than manipulation under anesthesia (MUA).

There are numerous causes of neurological deterioration in patients who harbor unstable cervical spinal injuries. These include inadequate immobilization, unrecognized rostral injuries, overdistraction, loss of reduction, and cardiac, respiratory, and hemodynamic instability. Therefore, an appropriately trained specialist must supervise the treatment, including attempted closed reduction, of patients with cervical spine fracture dislocation injuries.

Although prereduction MRI will demonstrate disk herniation in up to half of patients with acute cervical spinal facet subluxation injuries, the clinical importance of these findings is unknown. Only 2 case reports were found that document neurological deterioration caused by disk herniation following successful closed traction reduction. In addition, several investigators have demonstrated the lack of correlation between the MRI findings of disk herniation and neurological deterioration in this patient population. The use of prereduction MRI has therefore not been shown to improve the safety or efficacy of closed traction-reduction of patients with acute cervical fracture dislocation injuries. MRI before fracture/dislocation reduction may unnecessarily delay spinal column realignment for decompression of the spinal cord. There is Class III medical evidence that supports early closed reduction of cervical fracture/dislocation injuries with respect to neurological recovery. Prereduction MRI in this setting is not necessary. The ideal timing of closed reduction of cervical spinal fracture dislocation injuries is unknown, but many investigators favor reduction as rapidly as possible after injury to maximize the potential for neurological recovery.

Patients who fail attempted closed reduction of cervical fracture injuries have a higher incidence of anatomic obstacles to reduction, including facet fractures and disk herniations. Patients who fail closed reduction should undergo more detailed radiographic study/MRI before attempts at open reduction. The presence of a significant disk herniation in this setting is a relative indication for an anterior decompression procedure, either in lieu of or preceding a posterior procedure.

Patients with cervical fracture dislocation injuries who cannot be examined because of head injury or intoxication cannot be assessed for neurological deterioration during attempted closed reduction. For this reason, an MRI before attempted reduction (open or closed) is recommended as a treatment option on the basis of Class III medical evidence.

Definitions:

Rating Scheme for the Strength of the Evidence: Modified North American Spine Society Schema to Conform to Neurosurgical Criteria as Previously Published and for Ease of Understanding and Implementation: Levels of Evidence for Primary Research Question[a]

Class	Therapeutic Studies: Investigating the Results of Treatment	Diagnostic Studies: Investigating a Diagnostic Test	Clinical Assessment: Studies of Reliability and Validity of Observations, Including Clinical Examination, Imaging Results, and Classifications
I	High-quality randomized controlled trial with statistically significant difference or no statistically significant difference but narrow confidence intervals	Testing of previously developed diagnostic criteria on consecutive patients (with universally applied reference "gold" standard)	Evidence provided by 1 or more well-designed clinical studies in which interobserver and intraobserver reliability is represented by a Ä, statistic ≥0.60 or an intraclass correlation coefficient of ≥0.70
	Systematic review[b] of Class I randomized controlled trials (and study results were homogeneous[c])	Systematic review[b] of Class I studies	
II	Lesser-quality randomized controlled trial (e.g., <80% follow-up, no blinding, or improper randomization)	Development of diagnostic criteria on consecutive patients (with universally applied reference "gold" standard)	Evidence provided by 1 or more well-designed clinical studies in which interobserver and intraobserver reliability is represented by a Ä, statistic of 0.40–0.60 or an intraclass correlation coefficient of 0.50–0.70
	Prospective[d] comparative study[e]	Systematic review[b] of Class II studies	
	Systematic review[b] of Class II studies or Class I studies with inconsistent results	Study of nonconsecutive patients; without consistently applied reference "gold" standard	
	Case-control study[g]	Systematic review[b] of Class III studies	
	Retrospective[f] comparative study[e]	Case-control study	

Class	Therapeutic Studies: Investigating the Results of Treatment	Diagnostic Studies: Investigating a Diagnostic Test	Clinical Assessment: Studies of Reliability and Validity of Observations, Including Clinical Examination, Imaging Results, and Classifications
II	Systematic review[b] of Class II studies		
III	Case series[h]	Poor reference standard	Evidence provided by 1 or more well-designed clinical studies in which interobserver and intraobserver reliability is represented by a Ä, statistic of <0.40 or an intraclass correlation coefficient of <0.50
	Expert opinion	Expert opinion	

[a]A complete assessment of quality of individual studies requires critical appraisal of all aspects of the study design.

[b]A combination of results from 2 or more prior studies.

[c]Studies provided consistent results.

[d]Study was started before the first patient enrolled.

[e]Patients treated 1 way (e.g., halo vest orthosis) compared with a group of patients treated in another way (e.g., internal fixation) at the same institution.

[f]The study was started after the first patient was enrolled.

[g]Patients identified for the study on the basis of their outcome, called "cases" (e.g., failed fusion), are compared with those who did not have outcome, called "controls" (e.g., successful fusion).

[h]Patients treated 1 way with no comparison group of patients treated in another way.

Levels of Recommendation

Level I	Generally accepted principles for patient management, which reflect a high degree of clinical certainty (usually this requires Class I evidence which directly addresses the clinical questions or overwhelming Class II evidence when circumstances preclude randomized clinical trials)
Level II	Recommendations for patient management which reflect moderate clinical certainty (usually this requires Class II evidence or a strong consensus of Class III evidence)
Level III	Other strategies for patient management for which the clinical utility is uncertain (inconclusive or conflicting evidence or opinion)

Clinical Algorithm(s)

None provided

Scope

Disease/Condition(s)

Traumatic cervical spine fractures and cervical facet dislocation injuries

Guideline Category

Management

Clinical Specialty

Neurological Surgery

Orthopedic Surgery

Radiology

Intended Users

Advanced Practice Nurses

Hospitals

Nurses

Physician Assistants

Physicians

Guideline Objective(s)

To address the following issues:

- Is closed reduction safe and effective for reducing cervical spinal deformity/spinal cord compression in patients with cervical fractures and/or facet dislocation injuries?
- What is the risk of neurological injury following closed reduction of acute traumatic cervical fractures/facet dislocation injures?

Target Population

Patients with traumatic cervical spine fractures and cervical facet dislocation injuries

Interventions and Practices Considered

1. Early closed reduction of cervical spinal fracture/dislocation injuries with craniocervical traction
2. Prereduction magnetic resonance imaging (MRI)

Major Outcomes Considered

- Effectiveness and safety of closed reduction
- Incidence of neurological deterioration

Methodology

Methods Used to Collect/Select the Evidence

Hand-searches of Published Literature (Primary Sources)

Hand-searches of Published Literature (Secondary Sources)

Searches of Electronic Databases

Description of Methods Used to Collect/Select the Evidence

Search Criteria

To add to and update the previously analyzed medical evidence on this issue, a new National Library of Medicine (PubMed) computerized literature search was performed. Medical subject headings queried included "facet dislocation" or "fracture" or "dislocation" and "cervical spine."

This search resulted in 6705 citations. This search was combined with the term "reduction," yielding 527 potential citations. English language citations with abstracts limited to human subjects yielded 380 potential references. Restricting the search to 2001 to 2011 further refined the results to 155 citations. The abstracts of each of these citations were reviewed. As before, clinical series dealing with adult patients in the acute setting were selected. Case reports and case collections were included. Additional references were culled from the reference lists of the articles reviewed. Nine additional articles with clinical data germane to the issue of closed reduction of cervical spinal fractures were identified. These articles are summarized in the text, provided in Evidentiary Table format (refer to the Table in the original guideline document), and included in the bibliography.

As observed in the previous medical evidence-based review, there were no randomized clinical trials, no prospective cohort studies, and no case-control studies. The publications identified consisted of case series of patients with acute or subacute unilateral or bilateral cervical facet dislocation injuries and provide Class III medical evidence. In contrast to the original spinal cord injury guidelines publication, no report of permanent neurological deterioration following or resulting from closed reduction of a cervical spinal fracture injury has been published since 2000.

Number of Source Documents

Twenty-two references are summarized in Evidentiary Table format (refer to the table in the original guideline document).

Methods Used to Assess the Quality and Strength of the Evidence

Weighting According to a Rating Scheme (Scheme Given)

Rating Scheme for the Strength of the Evidence

Rating Scheme for the Strength of the Evidence: Modified North American Spine Society Schema to Conform to Neurosurgical Criteria as Previously Published and for Ease of Understanding and Implementation: Levels of Evidence for Primary Research Question[a]

Class	Therapeutic Studies: Investigating the Results of Treatment	Diagnostic Studies: Investigating a Diagnostic Test	Clinical Assessment: Studies of Reliability and Validity of Observations, Including Clinical Examination, Imaging Results, and Classifications
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II	Lesser-quality randomized controlled trial (e.g., <80% follow-up, no blinding, or improper randomization)	Development of diagnostic criteria on consecutive patients (with universally applied reference "gold" standard)	Evidence provided by 1 or more well-designed clinical studies in which interobserver and intraobserver reliability is represented by a Ä, statistic of 0.40–0.60 or an intraclass correlation coefficient of 0.50–0.70
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	Retrospective[f] comparative study[e]	Case-control study	
	Systematic review[b] of Class II studies		
III			

Class	Therapeutic Studies: Investigating the Results of Treatment	Diagnostic Studies: Investigating a Diagnostic Test	Clinical Assessment: Studies of Reliability and Validity of Observations, Including Clinical Examination, Imaging Results, and Classifications
	Case series[h]	Poor reference standard	Evidence provided by 1 or more well-designed clinical studies in which interobserver and intraobserver reliability is represented by a κ statistic of <0.40 or an intraclass correlation coefficient of <0.50
	Expert opinion	Expert opinion	

[a]A complete assessment of quality of individual studies requires critical appraisal of all aspects of the study design.

[b]A combination of results from 2 or more prior studies.

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[h]Patients treated 1 way with no comparison group of patients treated in another way.

Methods Used to Analyze the Evidence

Systematic Review with Evidence Tables

Description of the Methods Used to Analyze the Evidence

Selected articles were carefully reviewed by the authors. An evidentiary table was created (refer to the table in the original guideline document) that reflected the strengths and weaknesses of each article.

On occasion, the assessed quality of the study design was so contentious and the conclusions so uncertain that the guideline authors assigned a lower medical evidence classification than might have been expected without such a detailed review. In every way, adherence to the Institute of Medicine's criteria for searching, assembling, evaluating, and weighing the available medical evidence and linking it to the strength of the recommendations presented in this document was carried out.

Articles that did not achieve immediate consensus among the author group were discussed extensively until a consensus was reached. Very few contributions required extensive discussion. Most articles were easily designated as containing Class I, II, or III medical evidence using the criteria set forth by the author group at the initiation of the literature evaluation process (see the "Rating Scheme for the Strength of the Evidence" field).

Methods Used to Formulate the Recommendations

Expert Consensus

Description of Methods Used to Formulate the Recommendations

The current author group was selected for its expertise in spinal surgery (both neurosurgical and orthopedic), neurotrauma, clinical epidemiology, and, in several cases, prior experience with guideline development. The topics chosen for inclusion in this iteration of these guidelines are contemporary and pertinent to the assessment, evaluation, care, and treatment of patients with acute cervical spine and/or spinal cord injuries.

Rating Scheme for the Strength of the Recommendations

Levels of Recommendation

Level	Generally accepted principles for patient management, which reflect a high degree of clinical certainty (usually this requires Class I

I	evidence which directly addresses the clinical questions or overwhelming Class II evidence when circumstances preclude randomized clinical trials)
Level II	Recommendations for patient management which reflect moderate clinical certainty (usually this requires Class II evidence or a strong consensus of Class III evidence)
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Cost Analysis

A formal cost analysis was not performed and published cost analyses were not reviewed.

Method of Guideline Validation

Not stated

Description of Method of Guideline Validation

Not applicable

Evidence Supporting the Recommendations

Type of Evidence Supporting the Recommendations

The type of supporting evidence is identified and graded for each recommendation (see the "Major Recommendations" field). All of the supporting evidence was of Class III.

Benefits/Harms of Implementing the Guideline Recommendations

Potential Benefits

In the data derived from the literature published to date, closed reduction of fracture/dislocation injuries of the cervical spine by traction-reduction appears to be safe and effective for the reduction of acute traumatic spinal deformity in awake patients. Approximately 80% of patients will have their cervical fracture dislocation injuries reduced with this technique.

Potential Harms

- The incidence of neurological deterioration related to closed reduction remains low. Before 2001, the reported permanent neurological complication rate was <1.0%. Of the 11 patients reported to develop new permanent neurological deficits with attempted closed reduction, 2 had root injuries, and 2 had ascending spinal cord deficits noted at the time of reduction. Seven patients were noted to have decreased American Spinal Injury Association motor scores after reduction; however, neither the nature nor the cause of the new deficits in these patients was described.
- Transient neurological deterioration following closed reduction has also been reported with an incidence between 2% and 4%. Before 2001, temporary deficits were described in 20 patients of 1200 reported. These deficits reversed spontaneously or improved following reduction of weight or following open reduction. The causes of neurological deterioration associated with closed reduction in these and other series included overdistraction, failure to recognize a more rostral noncontiguous lesion, disk herniation, epidural hematoma, and spinal cord edema.

Refer to the original guideline document for more information regarding the risk of closed reduction of cervical spinal injuries.

Qualifying Statements

Qualifying Statements

- Medical evidence-based guidelines are not meant to be restrictive or to limit a clinician's practice. They chronicle multiple successful treatment options (for example) and stratify the more successful and the less successful strategies based on scientific merit. They are not absolute, "must be followed" rules. This process may identify the most valid and reliable imaging strategy for a given injury, for example, but because of regional or institutional resources, or patient co-morbidity, that particular imaging strategy may not be possible for a patient with that injury. Alternative acceptable imaging options may be more practical or applicable in this hypothetical circumstance.
- Guidelines documents are not tools to be used by external agencies to measure or control the care provided by clinicians. They are not medical-legal instruments or a "set of certainties" that must be followed in the assessment or treatment of the individual pathology in the individual patients we treat. While a powerful and comprehensive resource tool, guidelines and the recommendations contained therein do not necessarily represent "the answer" for the medical and surgical dilemmas faced with many patients.

Implementation of the Guideline

Description of Implementation Strategy

An implementation strategy was not provided.

Implementation Tools

Mobile Device Resources

For information about availability, see the *Availability of Companion Documents* and *Patient Resources* fields below.

Institute of Medicine (IOM) National Healthcare Quality Report Categories

IOM Care Need

Getting Better

IOM Domain

Effectiveness

Safety

Identifying Information and Availability

Bibliographic Source(s)

Gelb DE, Hadley MN, Aarabi B, Dhall SS, Hurlbert RJ, Rozzelle CJ, Ryken TC, Theodore N, Walters BC. Initial closed reduction of cervical spinal fracture-dislocation injuries. In: Guidelines for the management of acute cervical spine and spinal cord injuries. Neurosurgery. 2013 Mar;72(Suppl 2):73-83. [48 references] PubMed

Adaptation

Not applicable: The guideline was not adapted from another source.

Date Released

2013 Mar

Guideline Developer(s)

American Association of Neurological Surgeons - Medical Specialty Society

Congress of Neurological Surgeons - Professional Association

Source(s) of Funding

Congress of Neurological Surgeons

Guideline Committee

Guidelines Author Group of the Joint Section of Disorders of the Spine and Peripheral Nerves of the American Association of Neurological Surgeons and the Congress of Neurological Surgeons

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Financial Disclosures/Conflicts of Interest

The authors have no personal financial or institutional interest in any of the drugs, materials, or devices described in this guideline.

Guideline Status

This is the current release of the guideline.

Guideline Availability

Electronic copies: Available in Portable Document Format (PDF) and EPUB for eBook devices from the Neurosurgery Web site .

Availability of Companion Documents

The following are available:

- Foreword. Guidelines for the management of acute cervical spine and spinal cord injuries. Neurosurgery 2013;72(3):1. Electronic copies: Available in Portable Document Format (PDF) from the Neurosurgery Web site .
- Commentary. Guidelines for the management of acute cervical spine and spinal cord injuries. Neurosurgery 2013;72(3):2-3. Electronic copies: Available in PDF from the Neurosurgery Web site .
- Introduction to the guidelines for the management of acute cervical spine and spinal cord injuries. Neurosurgery 2013;72(3):5-16. Electronic copies: Available in PDF from the Neurosurgery Web site .
- Methodology of the guidelines for management of acute cervical spine and spinal cord injuries. Neurosurgery 2013;72(3):17-21. Electronic copies: Available in PDF from the Neurosurgery Web site .

Patient Resources

None available

NGC Status

This NGC summary was completed by ECRI Institute on July 9, 2013. The information was verified by the guideline developer on October 3, 2013.

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